Fish Kids & Combinatorics

Kit contains:

- 3 wooden blocks
- fish kid templates

You will need: scissors, glue, and a calculator (optional) if you want to investigate the math.

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Combinatorics is the branch of mathematics focused on selecting, arranging, and counting objects of different types. In this project, you will be investigating combinatorics while making fish kid blocks.

Math thing of note: A number followed by an exclamation point (**!**) means **factorial**: the product of that number and all of the whole numbers counting down to 1. **3! = 3 x 2 x 1 = 6**

INSTRUCTIONS

Step 1. Cut out 6 of the 12 fish kids, separating heads, torsos, and tails.

How many ways can you choose 6 fish kids? 924. Whoa! How does that work?

In this situation, you can use each fish kid at most once, and order doesn't matter. This is a case of **combinations without repetition**.

$$\frac{12!}{6!(12-6)!} = \frac{479{,}001{,}600}{720 \times 720} = \frac{479{,}001{,}600}{518{,}400} = 924$$

There are 924 different ways to choose 6 fish kids from a set of 12 possibilities. Whoa!

Step 2. Glue the 6 heads to the head block, the 6 torsos to the torso block, and the 6 tails to the tail block.

Now use your blocks to create mix-and-match fish kids! We'd say the possibilities are endless... but the math says otherwise. Each block gives you 6 different options. When you put them together, you get a countable ocean of possibilities.

HOW MANY FISH KIDS CAN YOU MAKE WITH YOUR BLOCKS?

You have 3 fish kid blocks. Cubes have 6 sides, so it make sense that each block gives you 6 options. For each head, you can choose 6 different torsos. With each torso, you can choose 6 different tails.

= 216 fish kids